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ABSTRACT

The model described in this manual is intended to assist national planners and others concerned with the allocation of resources in developing nations in arriving at informed decisions regarding national or regional educational activities. The focus of the model is on projecting yearly capital, recurrent, and total expenditures for national systems. Among other things it also estimates yearly enrollment and student output figures by year and grade, and projects teacher supply and demand by year and level of schooling. The model has been designed to provide estimates for primary and secondary programs but it can be expanded to include projections for tertiary level education and modified to serve specialized programs in vocational, technical, and teacher education. By exercising the model's sensitivity options, the user can estimate the future impact of changes in the system's current options and can estimate the future impact of changes in the system's current operating practices. The manual is divided into three sections. The first provides an overview of the model's operations. A fairly detailed description of the model's input requirements and user options is provided in the second. The third deals with the technical details of the model's specification. (Author/IRT)

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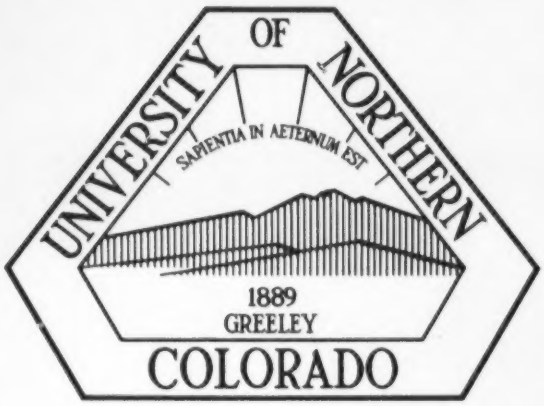

A Computer Model for The Allocation and Projection of National Educational Expenditures

BUREAU OF BUSINESS AND PUBLIC RESEARCH

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During the past year the model was completely redesigned; it was reprogrammed and its submodels integrated into their present form. A major debt is owed the staff of the Bureau of Business and Public Research for their assistance in the process. Specifically, the important contributions of Jack Freese (Associate Director), Douglas May and Cary Davis (Research Assistants) are acknowledged and appreciated.

Finally, our sincere thanks also go to the Bureau's secretary, Mrs. Mary Ann Ruybal. She typed and helped proofread the various drafts of the report.

William L. Duff, Jr.
Director

March, 1979

A Computer Model for the Allocation and Projection
of
National Education Expenditures

Introduction:

The model described in this manual is intended to assist national planners, and others concerned with the allocation of resources in developing nations, in arriving at informed decisions regarding national or regional educational activities. Specifically, the model projects the financial resources required to maintain proposed or existing primary and secondary level educational programs. In addition, the model permits a rather detailed examination of the real resource inputs required to run an educational system. The model also projects graduates from both primary and secondary schools by year.

This model is the first of a series of models to be developed by the Bureau of Business and Public Research at the University of Northern Colorado. Each of these models will be designed to run on an inexpensive, mini/micro computer system. Each will deal with a different application of mini/micro hardware to educational planning situations.[1]

The manual is divided into three sections. The first section provides an overview of the model's operation. It describes, in general terms, each of the five modules (or subprograms) that constitute the complete projection

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[1] In addition to our current work on an expanded version of this primary/secondary level financial projection model, the Bureau is also planning models that deal specifically with University level education, Voc/Tech Institutes, and Teacher Training Colleges. In addition, we intend to develop education statistics and personnel packages for use in primary and secondary level education.

model. A fairly detailed description of the model's input requirements and user options is provided in Section II. Section III deals with the technical details of the model's specification. In this final section the reader will find a complete trial run and a specification of hardware requirements.

Section I

OVERVIEW

Although this Financial Projection Model is upward compatible, it has been specifically designed to run on small mini/micro computers of 64k core storage capacity. Recent developments in computer technology have brought these machines within the easy financial grasp of planning units in Less Developed Countries (LDC's).[1] Widespread use of these computers for educational planning purposes, however, has not taken place. Their introduction into the field has been inhibited by a number of factors. Among the most important would probably be: 1) lack of knowledge regarding the rather dramatic changes in mini/micro computer technology, 2) the lack of appropriately trained personnel to operate and program the machines, and 3) the lack of easy to use, education specific, software packages. The model described in this paper is intended to deal, in part, with the last of these problems.

The focus of the model is on projecting yearly capital, recurrent and total expenditures for National Educational Systems in Less Developed Countries. Along the way the model estimates yearly enrollment and student output figures by year and grade. It also, among other things, projects teacher supply and demand by year and level of schooling.

The aperture of the model has been initially set to provide estimates for primary and secondary programs. It can be expanded to include projections for

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1 A suitable machine, including the necessary input/output and peripheral storage devices can be purchased for around $3,000 (retail) on the U.S. market.

tertiary level education and modified to serve specialized programs in vocational, technical and teacher education. Moreover, the model also provides projections for smaller educational units such as regions or administrative districts.

The model is intended to be of use to educational planning staffs, national policy makers, and financial administrators in LDC's. It may however, also be of use to others in development work. Aid donor agencies frequently require this type of information in order to appropriately evaluate proposed educational projects. For example, an aid donor agency may be considering a proposal to build a new teacher training college in an LDC. Typically, many questions must be answered before the donor agency will commit to funding the project. Is there a need for the facility's output? How will the new teachers be scheduled into the system? How and when will the expatriate teaching staff be scheduled in, and later, out? Does the LDC have the ability to staff the facility and can it provide the recurrent funds required for the facility's long-term operation? Does the LDC have the recurrent funds required to employ the facilities' graduates? This model can help answer these questions.

The model also does more. The user, by exercising the model's sensitivity options, can estimate the future impact of changes in the system's current operating policies. This is particularly useful to planners and educational administrators in evaluating the likely impact of proposed changes to the system. For example, a policy objective in an LDC might be to lower the pupil teacher ratio or to change classroom configurations, or perhaps, to adjust the existing teacher salary structure. An important job of an educational planner would be to estimate the costs of these changes. The model can easily do this. It would specify the recurrent and capital consequences of

each change. It would also specify the additional teachers, classrooms and facilities that might be needed to make each change. Obviously, this information would be useful to educational planners. Sensitivity studies of this type would also be of interest to aid donor agencies.

A look at the model's tabular displays may provide some insight into its potential uses. A simple flow chart of the model's operation is provided in Figure I. Each run of the model begins with the question "do you wish a complete rebuild?" If the user responds "NO," the computer will move directly to its sensitivity analysis section. This sensitivity option will be discussed later. If the user responds "YES," the computer will ask a series of questions and, after processing the user's responses, will provide the following tabular displays:

Display #1 - Enrollment projections by year and grade. This table also projects graduates by year and can be used to project student dropouts by year and grade.

Display #2 - Total supply of qualified teachers by year. This table projects a yearly breakdown of teaching force by qualifications while accounting for system wastage (teacher attrition) and estimating levels of expatriate employment.

Display #3 - Teacher supply and demand projections by year. This table displays the teacher force required to service projected student enrollments and the expected qualified teacher shortfall or surplus over the projection period.

Display #4 - Total recurrent expenditures by year during projection period. The table projects total recurrent budget totals by year and also specifies yearly expenditures for personnel salaries.

Display #5, 6, 7, 8, 9 - Physical facilities projections by type. This table displays existing physical facilities and the capital expenditure required to bring these facilities up to standard. In addition, this table identifies the capital expenditure required to provide new physical facilities for the projected growth in student enrollment.

Display #10 - Summary table projecting total capital expenditures by year. This table provides separate totals by type of physical facility provided. It is basically a summary of displays #5 through #9 discussed above.

Display #11 - Total expenditures (both recurrent and capital) for each year during the projection period. This table summarizes data previously reported in display #1, #3, #4 and #10.

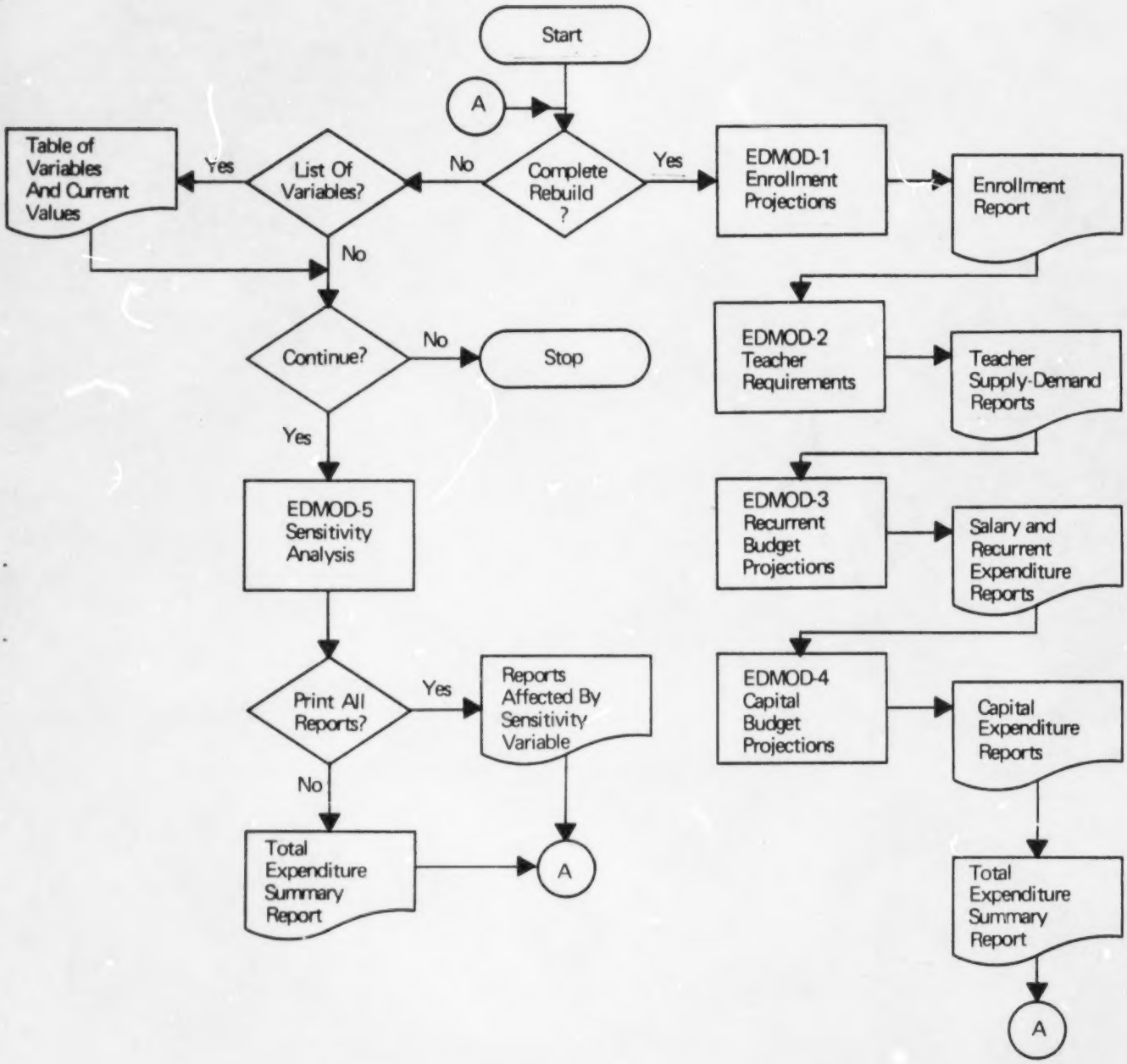
After the last table is displayed the computer will ask "do you wish to do sensitivity analysis?" If the user responds "NO," all user supplied inputs are stored on disc for future use and the program is terminated. If the user responds "YES," he moves to the sensitivity section and can change any one of twenty-two user provided inputs. After each sensitivity run the computer will then display, at the user's option, either Display #11 or all tables affected by the changed input.

The user can repeat the sensitivity process as many times as he likes. The model will change one sensitivity input at a time and always restore itself to the model's original input values after each sensitivity run. The original inputs are permanently stored on disc and can be recalled for future use.

If at the beginning of the model's operation the user replys "NO" to the query "Do you wish a complete rebuild?", the computer will take the inputs from the last complete run (this data could have been provided days or weeks before) and allows the user to do sensitivity analysis against this previously entered data.

FIGURE I

NATIONAL EDUCATIONAL EXPENDITURES
PROJECTION MODEL



Section II

EDMOD-1

Enrollment Projections

EDMOD-1 projects student enrollments by year and grade. It also projects graduates from the user specified system or subsystem. A Flow Chart of EDMOD-1 is found in Figure II. EDMOD-1 begins with the following questions:

Q-1 "What is the lowest grade in this level of schooling?"[1]

Q-2 "What is the highest grade in this level of schooling?"

The user's response to these questions partially dimension the projection and label the enrollment projection output table (Display #1). If the user is projecting primary school enrollments he might enter "1" for Q-1 and "7" for Q-2. On the other hand, if he wishes to project high school enrollments, he might enter "9" for Q-1 and "12" for Q-2.

Q-3 "What is the base year?"

The user's response will again be used to label the output table and partially dimension the model's projections. The user should enter the latest year for which he has actual student enrollment data. Base year (BY) is entered as a four-digit number (e.g., 1977).

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1 Input correction routines are not discussed in this section. For this reason the numbers of the questions will not follow the exact sequence of the computer's queries in the program.

Q-4 "The program will now request that you enter the enrollment figures for (BY). After the question mark, enter the enrollment figure for the grade indicated."

This statement is followed by a series of grades (running from lowest grade (Q-1) to highest grade (Q-2). The grades appear sequentially; after each response is entered, the next grade appears. The user should respond with the enrollment figure for the grade indicated in the base year.

Next the computer moves to a correction routine allowing the user to change any data he may have misentered in Q-4.

Q-5 "Do you wish the computer to calculate the rates for promotion, repetition, and dropouts (Yes or No)?"

If the user responds "NO," he will be asked to provide these rates in decimal fashion for each grade level specified. The format of the question is the same as Q-4.

If the user responds "YES," he will be asked to provide enrollment and repetition figures for base year minus 1 (e.g., if BY = 1977, the user provides the figures for 1976) and enrollment figures for base year. The computer will then calculate the student promotion, repetition, and dropout rates between these two years. The format of these questions is the same as the format of Q-4.

Whether the response to Q-5 is YES or NO, an input correction routine follows the user's entries.

Q-6 "Over how many years do you wish to project enrollments?" The user enters any integer between one (1) and twenty-five (25) inclusive. This value is used to specify the End Year (EY) of the projection. With this entry the computer has sufficient information to complete the dimensioning of the projection and the output table.

Next the computer asks the user the projection technique to be used.

Q-7 "The program will allow you to input requests for projections of school enrollment in four different ways. You may request enrollment projections based on':

(1) "A constant growth rate to an (EY) target figure." Here the user provides a target figure for the (EY) End Year (e.g., the user may wish to project to 80% of school age children in the End Year of the projection; in this case, he would enter the product of the school age population projection at EY and .80). The computer would then determine the yearly rate of growth required to reach the End Year figure and allocate each year's enrollment increase by grade.

(2) "A constant amount of growth per year to an (EY) target figure." Again, like option 1, the user provides the End Year enrollment figure. The computer allocates the growth by a constant amount (as opposed to rate) for each year of the projection. Grade enrollments for each year are then specified.

(3) "A specified growth rate to no particular target figure." Here the user supplies a rate of growth as a decimal fraction (say .03, indicating a 3% rate of growth). The computer then expands the system (beginning with the base year figures) and allocates enrollment changes to grade and year over the projection period.

(4) "A specific number of newcomers for each year of the enrollment projection." This option is used when newcomers to the system are known. Typically, this would be the case if the model was used to project at the second level of schooling (e.g., middle school) when the graduates from primary level schooling have been estimated by a previous run of the model. This option might be used at the primary level if universal primary education has been achieved and the newcomer age group (school entry age population) is known from an exogenous source (e.g., census projections).

At this point the computer prints out a table of enrollment projections by grade level and year (Display #1). It also gives total enrollment and graduates by year.

FIGURE II

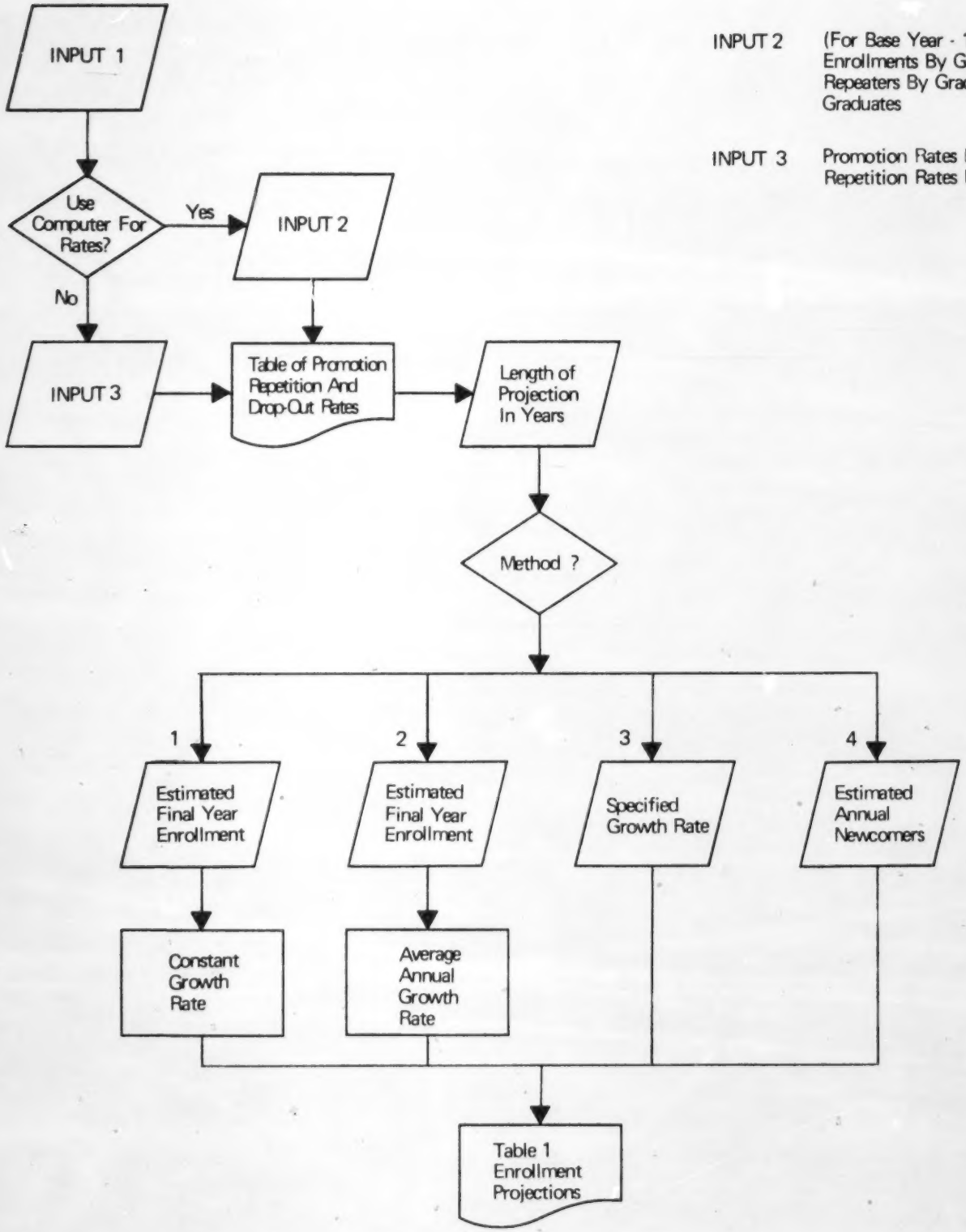
ENROLLMENT PROJECTIONS

EDMOD-1

INPUT 1 Upper And Lower Grade Base Year Enrollments By Grade

INPUT 2 (For Base Year - 1) Enrollments By Grade Repeaters By Grade Graduates

INPUT 3 Promotion Rates By Grade Repetition Rates By Grade



EDMOD-2

Teacher Requirements

EDMOD-2 projects total supply and demand for qualified teachers by year based upon the student enrollment projections of EDMOD-1 plus additional user provided inputs. This module adjusts its projections for targeted levels of expatriate employment. It also adjusts for attrition of the existing staff through retirement, death, or for other reasons that cause them to leave the profession.[1] A Flow Chart of this module is found in Figure III.

EDMOD-2 begins with queries specifying teacher employment levels.

Q-1 "How many qualified nationals teachers were on staff in (BY)?" The user enters the total integer number of teachers on staff during the base year. He should include only citizen teachers that meet or exceed the qualification requirements to teach in the level of schooling for which the projections are being prepared.

Q-2 "How many unqualified teachers were on staff in (BY)?" Here the user enters the total number of unqualified teachers employed by the system in the base year.

Q-3 "How many qualified expatriate teachers were on staff in (BY)?" Here the user enters the integer number of foreign nationals employed as

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1 In developing countries this attrition figure is often a very important consideration. The teacher force (a pool of educated manpower) is tempted to leave the profession by employment offers in the private sector and from other government agencies.

teachers during the base year. Only those employees that government considers temporary and qualified members of the teacher force should be included.

Q-4 "How many expatriates do you wart on the staff in (EY)?" Here the user enters a positive integer or zero. The entry must be equal to or smaller than the number of qualified expatriates on staff (Q-2) and equal to or larger than zero (0).

Q-5 "For each year indicated, input the number of newly qualified teachers you expect to join the staff." Here the computer sequentially displays a year (one for each year in the projection). The user is to enter the projected number of teachers expected to join the system in each year during the projection period. Typically this total will include outputs from teacher training colleges and nationals returning from foreign teacher training programs.

Q-6 "What teacher wastage rate do you expect during the projection period?" This rate is entered as a decimal fraction. Wastage (attrition) rates can be estimated by an examination of personnel files. They are sometimes given in available educational statistical abstracts. Typically wastage rates vary from about 2.5% or 3% in a developed country to as high as 12% in a developing country.

Q-7 "What is the desired pupil/teacher ratio in (EY)?" Here the user enters the number of students he expects to be served by one teacher in the End Year (EY).

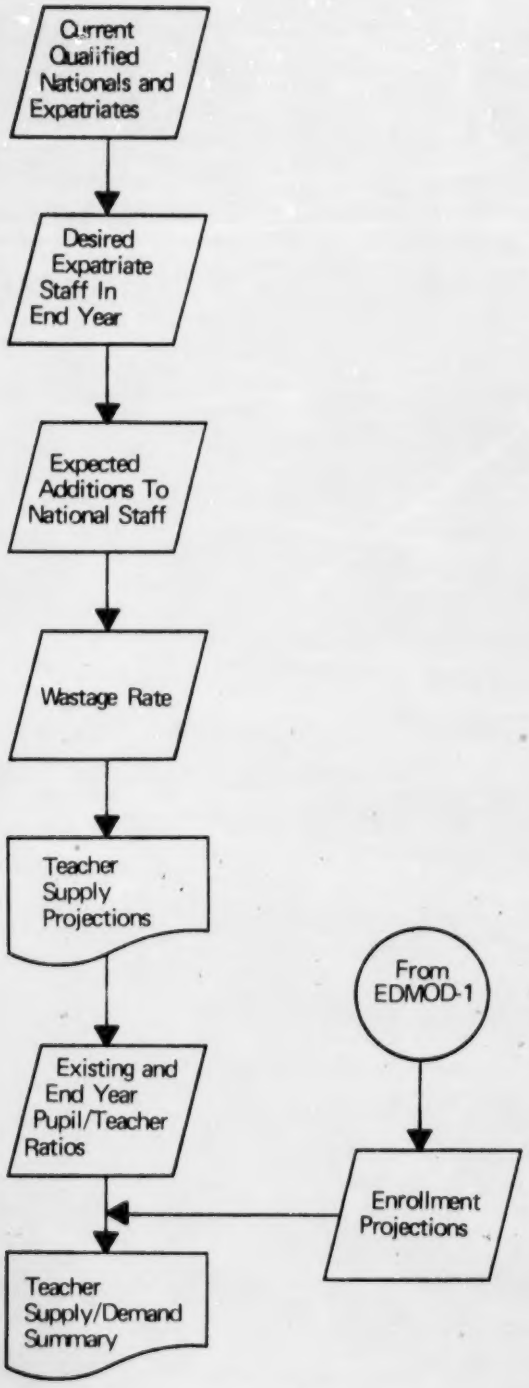
At this point the computer prints out a table displaying total teacher supply by year (Display #2.) This table provides yearly estimates of qualified teachers, expected additions to teaching force, numbers of expatriates, total supply of qualified teachers, and an estimate of the number of teachers lost to attrition.

A printout of a second table immediately follows (Display #3). This table projects teacher supply and demand by year. It includes the required teaching force, the expected number of qualified teachers, shortfall or surplus in qualified teachers, percent qualified teachers, and a yearly estimate of the pupil per qualified teacher ratio.

FIGURE III

TEACHER REQUIREMENTS

EDMOD-2



EDMOD-3

Recurrent Budget Projections

EDMOD-3 combines the data and calculations of EDMOD-1 and EDMOD-2 with additional information and provides projections of recurrent expenditure by year. A Flow Chart of this module is found in Figure IV.

In education programs, especially those in developing countries, most of the educational expenditures are for professional salaries. Indeed, even in developed countries approximately 70% of recurrent budgets go to teachers' salaries. This module begins with a specification of the average salary for teachers.

Q-1 "What is the average salary of a qualified teacher in (BY)?" The user should input the salary figure on an annual basis for the base year. This figure can be entered in any currency unit. Once a unit is chosen, however, the same unit must be used throughout this and successive modules.

Q-2 "What will be the average salary of a qualified teacher in (EY)?" This is a target salary level. The computer uses the information from Q-1 and Q-2, allocates the difference in equal increments of growth over each year of the projection.

Q-3 "What proportion of qualified teachers were paid by the government in (BY)? In a developing country there are frequently a large

number of private, usually mission run, schools. The user should input, in decimal form, the total number of qualified teachers actually paid by government divided by the total number of qualified teachers. Both these inputs are base year figures.

Q-4 "What proportion of the qualified teachers do you want the government to pay in (EY)?" This input reflects a policy decision of government. The entry may vary between a value of 0 or 100% in decimal form.

Q-5 "What was the average salary of an unqualified teacher in (BY)?" Here the user inputs the average salary of unqualified teachers during the base year.

Q-6 "What will be the average salary of an unqualified teacher in (EY)?" This entry is a target figure for an average salary expected to be paid to unqualified teachers at the end of the projection. This figure and the one entered in response to Q-5 are allocated in equal annual increments throughout the projection period.

Q-7 "What proportion of the unqualified teachers were paid by government in (BY)?" The user should enter the number of unqualified teachers presently paid by government divided by the total unqualified teaching force.

Q-8 "What proportion of the unqualified teachers do you want the government to pay in (EY)?" The user should estimate and enter the decimal fraction of the total unqualified teaching force the government

wishes to pay at the end of the projection period. The computer will allocate the difference between the response to this question and Q-7 in equal annual increments over the projection period.

Q-9 "What were the (BY) total personnel emoluments?" The user should enter the total salary figure for all employees of the system (this total should include all teachers, administrators, and other school related personnel associated with the particular level of education being specified).

Q-10 "What were the total recurrent expenditures during (BY)?" The user enters total recurrent expense for the base year.

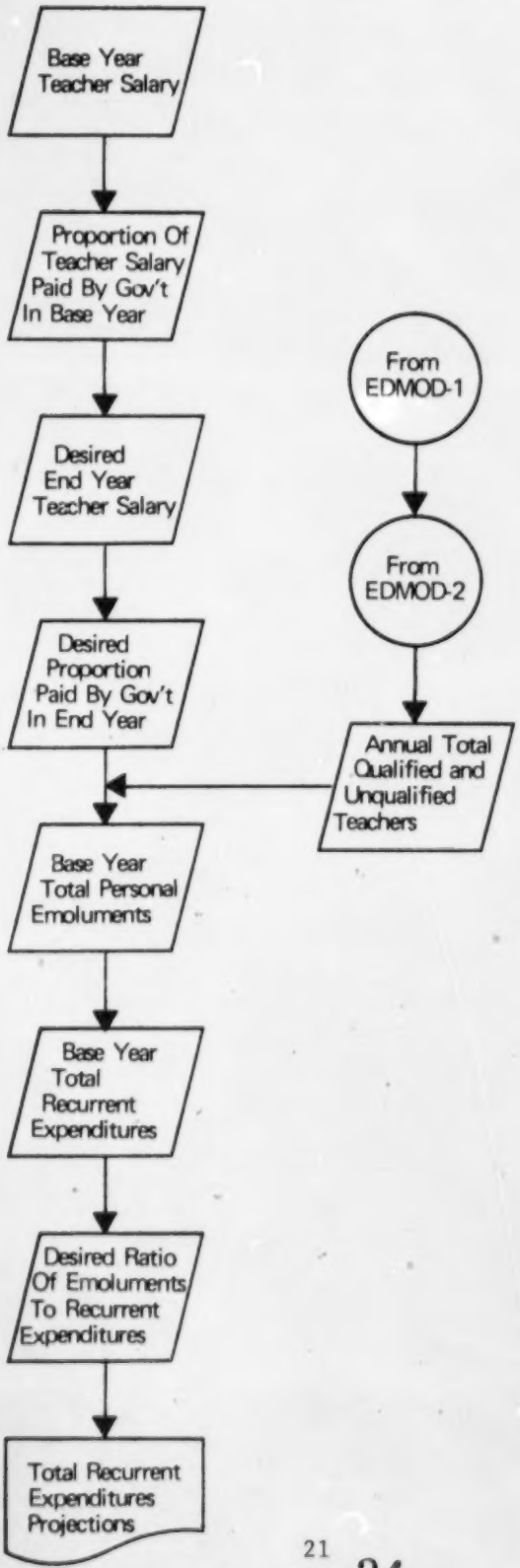
Q-11 "What adjustment factor of total personnel emoluments to total recurrent expenditures do you want to achieve in (EY)?" Here the user should enter the percentage (in decimal form) of total recurrent expenditures that the users wish to go to salaries during the last year of the projection. One minus this fraction is the amount he wishes to devote to nonsalary recurrent expense (e.g., classroom supplies, teaching materials, etc.).

This question is followed by a tabular display projecting teacher salaries and total recurrent expenditures by year (Display #4). The table lists the total salary bill for qualified and unqualified teachers separately. It also redisplays the total number of teachers in each category over each year of the projection period.

FIGURE IV

RECURRENT BUDGET PROJECTIONS

EDMOD-3


Base Year Teacher Salary
Proportion Of Teacher Salary Paid By Gov't In Base Year
Desired End Year Teacher Salary
Desired Proportion Paid By Gov't In End Year
From EDMOD-1
From EDMOD-2
Annual Total Qualified and Unqualified Teachers
Base Year Total Personal Emoluments
Base Year Total Recurrent Expenditures
Desired Ratio Of Emoluments To Recurrent Expenditures
Total Recurrent Expenditures Projections

EDMOD-4

Capital Budget Projections

This module builds on the user's responses to previous questions. In addition, the user is asked to provide new information regarding educational space standards, existing physical facilities, and current construction costs. A Flow Chart of this module is provided in Figure V.

This module treats capital cost as the sum of three separate components: 1) the costs, if any, of bringing existing physical facilities up to standard, 2) the costs of providing physical facilities for projected new student enrollments and, 3) the capital costs required to maintain these physical facilities during the projection period. The module begins with a series of questions regarding educational space standards.

Q-1 "How many square feet of classroom space are needed per student?" Here the user enters the total square feet (or meters) in a standard classroom divided by the number of students the classroom is expected to serve. Once the user selects a unit of measurement he must use the same unit throughout this model.

Q-2 "What is the construction cost per square foot of classroom space?" Here the user enters the current construction cost per square foot (or meters) of classroom space.

Q-3 "What is the equipment cost per square foot of classroom space?" This total should include the average capital cost of equipping a classroom. Items recurrent in nature (e.g., paper, chalk, etc.) are not included in this total. Capital items such as desks, chairs, file cabinets, and blackboards are included in this total.

These three questions are repeated with regard to square foot and costs of providing teacher housing, administrative offices, and toilet facilities. If any of these additional facilities are not required, the user should enter "0" (zero) indicating that no square feet are required. In addition if toilet facilities (or perhaps, halls, lockers, dormitory/cafeteria space) are included in standard school construction, these figures can be included in his response to the classroom square footage and cost questions.

Q-4 "What is the annual average replacement cost of capital equipment as a percentage of the total value of base-year facilities?" UNESCO estimates that in general 2% to 5% of capital value should be allowed for replacement of physical facilities. Because facilities in LDC's are typically of rather recent origin the user might wish to enter a figure on the lower end of the range. (See, J.D. Chesswas, Methodologies of Educational Planning in Developing Countries: I Text, UNESCO, 1969, page 85.)

The module next deals with a series of questions regarding existing physical facilities. These questions follow the pattern used in the standard questions described in Q-1 and Q-2 above.

Q-5 "What is the base year classroom space in square feet?" The user's response may be in square feet or meters, depending on how he entered the cost information. It is important that the user be consistent in the unit of measurement he chooses.

Similar questions are asked about base year teacher housing, administrative office space, and toilet facilities. The user should respond in the same way he responded to the standard questions. His responses, however, should reflect the square feet (meters) of existing facilities of each type available to the system in the base year.

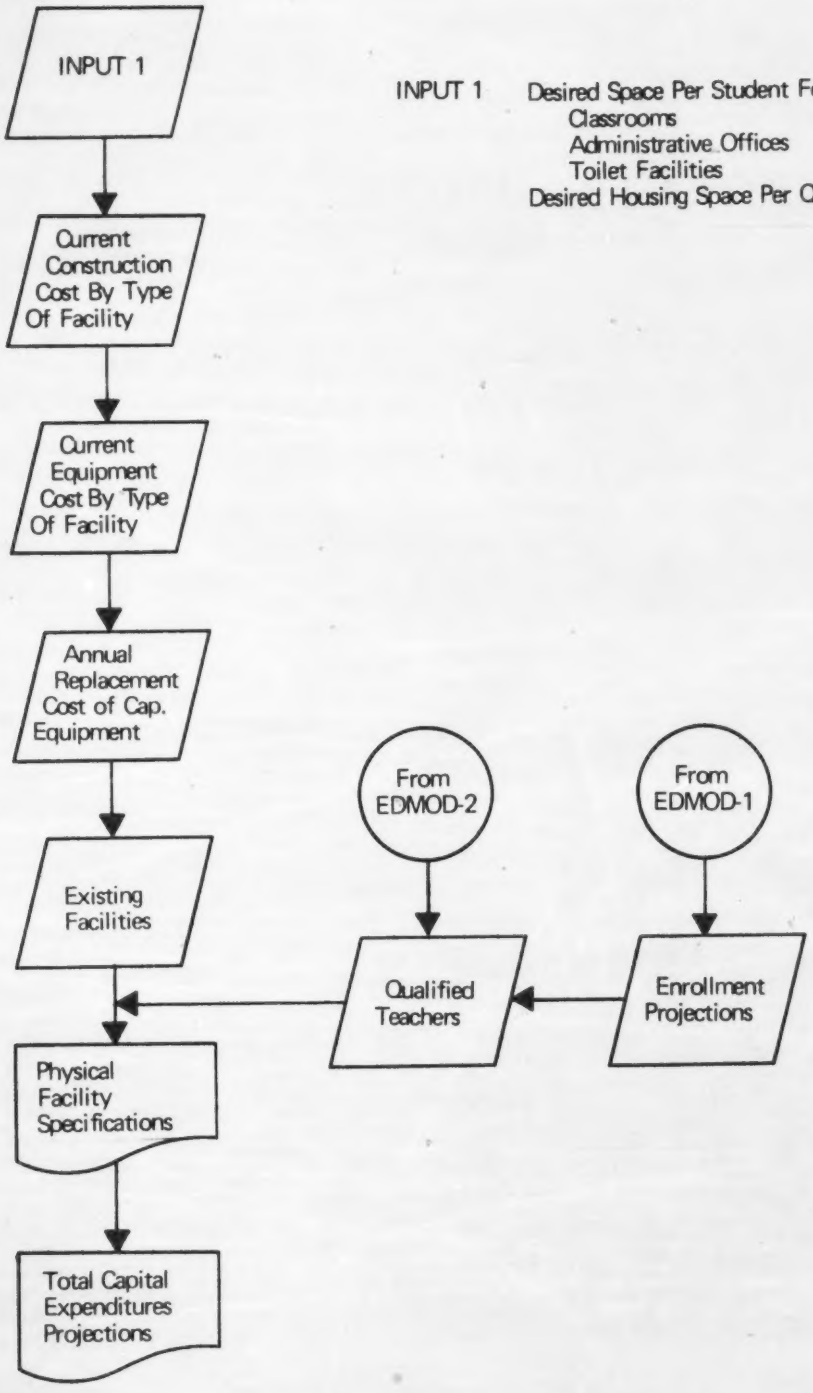
The computer then prints a series of tables specifying the shortfall or surplus and costs of physical facilities of each type (Display #5, 6, 7, 8, and 9). Information regarding facilities required to service new students is computed using data from previous modules and the standard requirements of EDMOD-4. The information about existing facilities allows the computer to estimate existing surplus or shortfall in physical facilities. This latter total is scheduled in (either added or deleted, depending upon whether a current shortage or surplus exists) on a yearly basis to the projected new facilities' requirements.

Immediately following Display #10 the computer prints Display #11, a summary table. This table displays total enrollments, total qualified teachers, total teachers, total recurrent, total capital, and grand total expenditure estimates by year.

FIGURE V

CAPTIAL BUDGET PROJECTIONS

EDMOD-4



EDMOD-5

Sensitivity Analysis

This module allows the user to change any one of the user supplied inputs to the model. The program will automatically use the changed input, leaving the remaining inputs unchanged, and respecify the entire model. Each computation affected by the changed input is recalculated. The user has the option of having the computer print all the display tables affected by the change or just the total cost summary table (Display #11). A listing of the sensitivity variables provides a) the variables code number, b) the names of the sensitivity variable and, c) the existing value of the sensitivity variable. The following is a list of the sensitivity options in the order they appear in the computer output.

1. "Progression Rate Table"-bv exercising this option the user can change the matrix of progression rates (promotion, repetition and dropout rates) for each grade level. By changing the graduation rate (typically the last grade level), this option can be used to measure the impact of changing examination standards.

2. "Enrollment Progression Method (target and technique)"-this option permits the user to select another enrollment projection technique. system growth rate or to change the End Year enrollment projection target.

3. "Number of Qualified Expatriates at the End of Projection Period"-this option allows the user to change the scheduling in or out of the nonnational teacher force.

4. "Annual Newly Qualified Teachers"-this option allows the user to change the scheduling in or out of newly qualified teachers. It can conveniently be used to measure the impact of a proposed (new) teacher training facility on the system.

5. "Teacher Wastage Rate"-this option permits the user to adjust the rate of qualified teacher attrition from the system. It could be used to estimate the impact of changing teacher contractual arrangements.

6. "Desired Pupil/Teacher Ratio at End of Projection Period"-this option allows the user to raise or lower target pupil/teacher ratios and, of course, to estimate the resultant costs of the change.

7. "Projected Average Teacher Salaries (New Target)"-this option allows the user to estimate the End-Year target teacher salary for both qualified and unqualified teachers.

8. "Projected Proportion of Teachers Paid by Government (New Target)"-this option permits the user to estimate the cost involved in nationalizing the teacher force. By exercising this option, the user can change the percentage of both qualified and unqualified teachers paid by government.

9. "Current and End of Projection Teacher Salaries"-this option permits the user to adjust average teacher salaries in current year (base year plus one) and to adjust target year (End Year) average teacher salaries for both the qualified and unqualified teaching staff. These adjustments permit an administrator to estimate the current and future impacts of change in the teacher salary level. It does not account for the affect the change in teachers' salaries might have on teacher wastage (attrition) rates or the secondary affects this change might have on the number of new teachers entering the system during the projection period.

10. "Adjustment-Factor Total Enrollments to Total Recurrent Expense at End of Projection"-this option permits the user to adjust the percentage of nonsalary recurrent expenditures over projection period.

11. "Desired Square Footage (Meters) of Classroom Space Per Student"-this option permits the user to adjust the classroom space standards for projection.

12. "Classroom Construction Cost Per Square Foot"-this option allows the user to adjust to estimated classroom construction costs.

13. "Classroom Equipment Cost Per Square Feet (Meters)"-this option permits adjustments in the non-teacher salary fraction of recurrent expenditures.

14. "Desired Square Feet (Meters) of Teacher Housing Per Teacher"-this option permits adjustments in the standard of space allocation for teacher accommodations.

15. "Teacher Housing Cost Per Square Foot (Meters)"-this option allows adjustment in the costs of construction of teacher houses.

16. "Teacher House Furnishing Costs Per Square Foot (Meters)'-this option allows adjustments in the costs of furnishing teacher houses.

17. "Desired Square Feet (Meters) of Administrative Facility Per Student"-this option allows adjustments in administrative space standard.

18. "Administrative Space Costs Per Square Foot"-this option allows adjustments in the cost of construction of administrative space.

19. "Administrative Equipment Cost Per Square Foot (Meters)"-this option allows adjustments in the cost of administrative equipment.

20. "Desired Square Feet (Meters) of Toilet Facilities Per Student"-this option allows the user to change the toilet facilities space standards required per student.

21. "Toilet Costs Per Square Foot (Meters)"-this option allows adjustments in the cost of toilet facilities.

22. "Annual Replacement Cost of Capital Equipment"-this permits the user to adjust his depreciation schedule for capital equipment.

SECTION III

COMPLETE SPECIFICATION OF MODEL

```
ENTER (1) FOR A COMPLETE REBUILD OR (2) FOR SENSITIVITY ANALYSIS? 1

                              EDMOD1
                    ENROLLMENT PROJECTIONS

WHAT IS THE LOWEST GRADE IN THIS LEVEL OF SCHOOLING ? 1

WHAT IS THE HIGHEST GRADE IN THIS LEVEL OF SCHOOLING? 7

WHAT IS THE BASE YEAR (THE LATEST YEAR FOR WHICH YOU ACTUALLY
HAVE ENROLLMENT DATA) ? 1977

THE PROGRAM WILL NOW REQUEST THAT YOU ENTER THE ENROLLMENT
FIGURES FOR 1977. AFTER THE QUESTION MARK ENTER THE ENROLLMENT
FIGURE FOR THE GRADE INDICATED.
GRADE  1? 19808
GRADE  2? 16564
GRADE  3? 15304
GRADE  4? 13168
GRADE  5? 12029
GRADE  6? 10346
GRADE  7? 9616

DO YOU WISH TO MAKE ANY CHANGES IN THE ENROLLMENT FIGURES
DISPLAYED IN THE ABOVE TABLE (YES OR NO)? NO

DO YOU WISH THE COMPUTER PROGRAM TO CALCULATE THE RATES
FOR PROMOTION, REPETITION, AND DROPOUTS,(YES OR NO) ? YES

HOW MANY SUCCESSFULLY COMPLETED (GRADUATED FROM) GRADE  7 IN 1976 ? 6504

THE PROGRAM WILL NOW REQUEST THAT YOU ENTER THE ENROLLMENT
FIGURES FOR 1976, AFTER THE QUESTION MARK ENTER THE ENROLLMENT
FIGURE FOR THE GRADE INDICATED.
GRADE  1? 18357
GRADE  2? 15631
GRADE  3? 14435
GRADE  4? 13046
GRADE  5? 11454
GRADE  6? 10162
GRADE  7? 9636

THE PROGRAM WILL NOW REQUEST THAT YOU ENTER THE NUMBER
OF STUDENTS REPEATING EACH GRADE IN 1977
GRADE  1? 1955
GRADE  2? 1369
GRADE  3? 1538
GRADE  4? 1348
GRADE  5? 1317
GRADE  6? 1166
GRADE  7? 1494
```

IN ORDER TO CHECK THE ACCURACY OF THE INPUT DATA A TABLE WILL FOLLOW SHOWING ACTUAL ENROLLMENT FIGURES FOR 1976 AND 1977 WITH THE NUMBER OF STUDENTS REPEATING GRADES FOR 1977.

GRADE LEVEL	1976 ENROLLMENTS	1977 ENROLLMENTS	1977 NUMBER REPEATING
GRADE 1	18,357	19,808	1,955
GRADE 2	15,631	16,564	1,369
GRADE 3	14,435	15,304	1,538
GRADE 4	13,046	13,168	1,348
GRADE 5	11,454	12,029	1,317
GRADE 6	10,162	10,346	1,166
GRADE 7	9,636	9,616	1,494
TOTALS	92,721	96,835	10,187

ARE THERE ANY ERRORS IN YOUR INPUT (YES OR NO)? NO

THE FOLLOWING TABLE SHOWS THE PROMOTION, REPETITION, AND DROP OUT RATES TO BE USED BY THE COMPUTER IN DETERMINING ENROLLMENT PROJECTIONS.

PROGRESSION RATES

GRADE LEVEL	PROMOTION RATE	REPETITION RATE	DROPOUT RATE
GRADE 1	.828	.106	.066
GRADE 2	.881	.088	.032
GRADE 3	.819	.107	.075
GRADE 4	.821	.103	.076
GRADE 5	.801	.115	.084
GRADE 6	.799	.115	.086
GRADE 7	.675	.155	.170

OVER HOW MANY YEARS DO YOU WISH TO PROJECT ENROLLMENTS? 4

THE PROGRAM WILL ALLOW YOU TO INPUT REQUESTS FOR PROJECTIONS OF SCHOOL ENROLLMENT IN FOUR DIFFERENT WAYS. YOU MAY REQUEST ENROLLMENT PROJECTIONS BASED ON

(1) A CONSTANT GROWTH RATE TO A 1981 TARGET FIGURE.
(2) A CONSTANT AMOUNT OF GROWTH PER YEAR TO A 1981 TARGET FIGURE.
(3) A SPECIFIED GROWTH RATE TO NO PARTICULAR TARGET FIGURE.
- OR -
(4) A SPECIFIC NUMBER OF NEWCOMERS FOR EACH YEAR OF THE PROJECTION.

ENTER THE NUMBER OF THE METHOD YOU DESIRE TO PROJECT THE ENROLLMENT FIGURES? 1

WHAT WILL BE THE ENROLLMENT IN 1981 ? 114000

THE FOLLOWING TABLE SHOWS THE ENROLLMENT PROJECTIONS FOR EACH OF THE GRADE LEVELS FOR ALL YEARS DESIRED. THE TABLE IS BASED ON A CONSTANT GROWTH RATE OF 4.164%.

ENROLLMENT PROJECTIONS

GRADE LEVEL	1977	1978	1979	1980	1981
NEWCOMERS	0	18,017	18,546	19,336	19,994
GRADE 1	19,808	20,127	20,690	21,540	22,288
GRADE 2	16,564	17,847	18,223	18,722	19,469
GRADE 3	15,304	16,218	17,445	17,907	18,396
GRADE 4	13,168	13,892	14,716	15,806	16,296
GRADE 5	12,029	12,195	12,809	13,556	14,537
GRADE 6	10,346	10,828	11,017	11,530	12,187
GRADE 7	9,616	9,760	10,167	10,381	10,825
TOTALS	96,835	100,867	105,067	109,442	113,999
GRADUATES (END OF YEAR)	96	6,588	6,863	7,007	7,307

EDMOD2
TEACHER REQUIREMENTS

HOW MANY QUALIFIED NATIONAL TEACHERS WERE ON STAFF IN 1977? 1863

HOW MANY UNQUALIFIED TEACHERS WERE ON STAFF IN 1977 ? 688

HOW MANY QUALIFIED EXPATRIATE TEACHERS WERE ON STAFF IN 1977? 121

HOW MANY EXPATRIATES DO YOU WANT ON STAFF IN 1981 ? 80

FOR EACH YEAR INDICATED INPUT THE NUMBER OF NEWLY QUALIFIED
TEACHERS YOU EXPECT TO JOIN THE STAFF.

1978? 259
1979? 409
1980? 290
1981? 140

WHAT TEACHER WASTAGE RATE DO YOU EXPECT DURING THE PROJECTION PERIOD? .06

THE PUPIL/TEACHER RATIO IN 1977 IS 36.24

WHAT IS THE DESIRED PUPIL/TEACHER RATIO IN 1981 ? 32.0

TOTAL SUPPLY OF QUALIFIED TEACHERS

	CITIZENS					
YEAR	QUALIFIED TEACHERS	ADDITIONS TO TEACHING FORCE	TOTAL QUALIFIED TEACHERS	NON-CITIZENS	TOTAL SUPPLY	TEACHERS LEAVING (ATTRITION AND NON-CITIZENS)
1977	1,863	0	1,863	121	1,984	112
1978	1,751	259	2,010	111	2,121	131
1979	1,890	409	2,299	101	2,399	148
1980	2,161	290	2,451	90	2,541	157
1981	2,304	140	2,444	80	2,524	157

TEACHER FORCE PROJECTION FOR GRADES 1 THROUGH 7

YEAR	TOTAL STUDENTS	PUPIL/ TEACHER RATIO	REQUIRED TEACHING FORCE	NO. OF QUALIFIED TEACHERS	QUALIFIED TEACHER SHORTFALL	% QUALIFIED TEACHERS	PUPILS/ QUALIFIED TEACHER
1977	96,835	36.2	2,672	1,984	688	74.3	49
1978	100,867	35.2	2,867	2,121	746	74.0	48
1979	105,067	34.1	3,079	2,399	680	77.9	44
1980	109,442	33.1	3,310	2,541	769	76.8	43
1981	113,999	32.0	3,562	2,524	1,039	70.8	45

EDMOD3
RECURRENT BUDGET PROJECTIONS

WHAT WAS THE AVERAGE SALARY OF A QUALIFIED TEACHER IN 1977? 1496

WHAT WILL BE THE AVERAGE SALARY OF A QUALIFIED TEACHER IN 1981? 1700

WHAT PROPORTION OF QUALIFIED TEACHERS WERE PAID BY THE
GOVERNMENT IN 1977? .98

WHAT PROPORTION OF THE QUALIFIED TEACHERS DO YOU WANT
THE GOVERNMENT TO PAY IN 1981 ? 1.00

WHAT WAS THE AVERAGE SALARY OF AN UNQUALIFIED TEACHER IN 1977 ? 1008

WHAT WILL BE THE AVERAGE SALARY OF AN UNQUALIFIED TEACHER IN 1981 ? 1200

WHAT PROPORTION OF THE UNQUALIFIED TEACHERS WERE PAID
BY THE GOVERNMENT IN 1977 ? .75

WHAT PROPORTION OF THE UNQUALIFIED TEACHERS DO YOU WANT THE
THE GOVERNMENT TO PAY IN 1981 ? .88

WHAT WERE THE 1977 TOTAL PERSONAL EMOLUMENTS? 3354000

WHAT WERE THE TOTAL RECURRENT EXPENDITURES DURING 1977? 3426000

WHAT ADJUSTMENT FACTOR OF TOTAL PERSONAL EMOLUMENTS TO TOTAL
RECURRENT EXPENDITURES DO YOU WANT TO ACHIEVE IN 1981 ? .90

TEACHER SALARIES

YEAR	NO. OF QUALIFIED TEACHERS	% QUALIFIED PAID BY GOVERNMENT	AVERAGE SALARY (QUALIFIED)	NO. OF UNQUALIFIED TEACHERS	% UNQUALIFIED PAID BY GOVERNMENT	AVERAGE SALARY (UNQUALIFIED)
1977	1,984	.9800	$1,496	688	.7500	$1,008
1978	2,121	.9850	$1,547	746	.7825	$1,056
1979	2,399	.9900	$1,598	680	.8150	$1,104
1980	2,541	.9950	$1,649	769	.8475	$1,152
1981	2,524	1.0000	$1,700	1,039	.8800	$1,200

RECURRENT EXPENDITURE PROJECTIONS

YEAR	BASE ESTIMATE OF PERSONAL EMOLUMENTS	SALARY TO EMOLUMENT ADJUSTMENT	ADJUSTED ESTIMATE OF TOTAL PERSONAL EMOLUMENTS	EMOLUMENTS TO RECURRENT ADJUSTMENT	ESTIMA RECURRE EXPENDITU
1977	$ 3,428,831	.9782	$ 3,354,000	.9790	$ 3,426,0
1978	$ 3,848,404	.9782	$ 3,764,416	.9592	$ 3,924,3
1979	$ 4,407,103	.9782	$ 4,310,922	.9395	$ 4,588,5
1980	$ 4,919,949	.9782	$ 4,812,576	.9197	$ 5,232,5
1981	$ 5,387,984	.9782	$ 5,270,397	.9000	$ 5,855,9

EDMOD4
CAPITAL BUDGET PROJECTIONS

THE FOLLOWING QUESTIONS ASK ABOUT STANDARDS TO BE USED IN PROJECTING FACILITY NEEDS FOR GIVEN STUDENT ENROLLMENTS AND TEACHER SUPPLY. (NOTE: THE METRIC MAY BE METERS RATHER THAN FEET.)

HOW MANY SQUARE FEET OF CLASSROOM SPACE ARE NEEDED PER STUDENT? 20

WHAT IS THE CONSTRUCTION COST PER SQUARE FOOT OF CLASSROOM SPACE? 8.25

WHAT IS THE EQUIPMENT COST PER SQUARE FOOT OF CLASSROOM SPACE ? .86

HOW MANY SQUARE FEET OF TEACHER HOUSING ARE NEEDED PER QUALIFIED TEACHER ? 900

WHAT IS THE CONSTRUCTION COST PER SQUARE FOOT OF TEACHER HOUSING? 8.00

WHAT IS THE FURNISHING COST PER SQUARE FOOT OF TEACHER HOUSING? .98

HOW MANY SQUARE FEET OF ADMINISTRATIVE FACILITIES ARE NEEDED PER STUDENT ? 3

WHAT IS THE CONSTRUCTION COST PER SQUARE FOOT OF ADMINISTRATIVE OFFICE SPACE? 8.33

WHAT IS THE FURNISHING COST PER SQUARE FOOT OF ADMINISTRATIVE FACILITIES? .64

HOW MANY SQUARE FEET OF TOILET FACILITIES ARE NEEDED PER STUDENT? 1

WHAT IS THE CONSTRUCTION COST PER SQUARE FOOT ? 34.5

WHAT IS THE ANNUAL AVERAGE REPLACEMENT COST OF CAPITAL EQUIPMENT AS A PERCENTAGE OF THE TOTAL VALUE OF THESE BASE YEAR FACILITIES (ENTER IN DECIMAL FORM) ? .05

THE FOLLOWING QUESTIONS CONCERN INFORMATION ABOUT EXISTING FACILITIES. THESE FIGURES WILL BE COMPARED TO PROJECTED FACILITIES IN ORDER TO DETERMINE ANY CONSTRUCTION REQUIRED TO BRING EXISTING FACILITIES UP TO STANDARD.

WHAT IS THE BASE YEAR CLASSROOM SPACE IN SQUARE FEET? 1500000

WHAT IS THE BASE YEAR TEACHER HOUSING SPACE IN SQUARE FEET? 1100000

WHAT IS THE BASE YEAR ADMINISTRATIVE OFFICE SPACE IN SQUARE FEET? 250000

WHAT IS THE BASE YEAR TOILET FACILITY SPACE IN SQUARE FEET? 60000

PHYSICAL FACILITIES REQUIRED TO SERVICE
EXISTING ENROLLMENTS IN 1977

	CLASSROOMS	TEACHER HOUSES	ADMINISTRATIVE OFFICES	TOILET FACILITIES
REQUIRED	1,936,700	1,785,600	290,505	96,835
EXISTING	1,500,000	1,100,000	250,000	60,000
DIFFERENCE	436,700	685,600	40,505	36,835

THE FOLLOWING SERIES OF TABLES SHOW THE AMOUNT OF NEW FACILITIES WITHIN EACH CATEGORY NEEDED BY YEAR.

ADDITIONAL CLASSROOM SPACE NEEDED PER YEAR

YEAR	REQUIRED SPACE FOR NEW STUDENTS	REQUIRED SPACE TO BRING FACILITIES TO STANDARD	COST OF REQUIRED SPACE	FURNITURE AND EQUIPMENT COST	TOTAL COST *
1978	80,640	109,175	$ 1,565,974	$ 163,241	$ 2,347,965
1979	84,000	109,175	$ 1,593,694	$ 166,130	$ 2,378,574
1980	87,500	109,175	$ 1,622,569	$ 169,140	$ 2,410,459
1981	91,140	109,175	$ 1,652,599	$ 172,271	$ 2,443,620

* TOTAL COST INCLUDES $618,750 (5% OF BASE) AS AS ESTIMATE OF ANNUAL REPLACEMENT COSTS DURING THE PROJECTION PERIOD.

ADDITIONAL TEACHER HOUSING NEEDED PER YEAR

YEAR	REQUIRED SPACE FOR NEW STUDENTS	REQUIRED SPACE TO BRING FACILITIES TO STANDARD	COST OF REQUIRED SPACE	FURNITURE AND EQUIPMENT COST	TOTAL COST *
1978	123,300	171,400	$ 2,357,600	$ 288,806	$ 3,086,406
1979	250,200	171,400	$ 3,372,800	$ 413,168	$ 4,225,968
1980	127,800	171,400	$ 2,393,600	$ 293,216	$ 3,126,816
1981	0	171,400	$ 1,371,200	$ 167,972	$ 1,979,172

* TOTAL COST INCLUDES $440,000 (5% OF BASE) AS AS ESTIMATE OF ANNUAL REPLACEMENT COSTS DURING THE PROJECTION PERIOD.

Errata insert between pages 36 and 37

ADDITIONAL ADMINISTRATIVE OFFICES NEEDED PER YEAR

YEAR	REQUIRED SPACE FOR NEW STUDENTS	REQUIRED SPACE TO BRING FACILITIES TO STANDARD	COST OF REQUIRED SPACE	FURNITURE AND EQUIP-MENT COST	TOTAL COST *
1978	12,096	10,126	$ 185,111	$ 14,222	$ 303,459
1979	12,600	10,126	$ 189,310	$ 14,545	$ 307,979
1980	13,125	10,126	$ 193,683	$ 14,881	$ 312,689
1981	13,671	10,126	$ 198,231	$ 15,230	$ 317,586

* TOTAL COST INCLUDES $104,125 (5% OF BASE) AS AS ESTIMATE OF ANNUAL REPLACEMENT COSTS DURING THE PROJECTION PERIOD.

ADDITIONAL TOILET FACILITIES NEEDED PER YEAR

YEAR	REQUIRED SPACE FOR NEW STUDENTS	REQUIRED SPACE TO BRING FACILITIES TO STANDARD	COST OF REQUIRED SPACE	FURNITURE AND EQUIP-MENT COST	TOTAL COST *
1978	4,032	9,209	$ 456,806		$ 560,306
1979	4,200	9,209	$ 462,602		$ 566,102
1980	4,375	9,209	$ 468,639		$ 572,139
1981	4,557	9,209	$ 474,918		$ 578,418

* TOTAL COST INCLUDES $103,500 (5% OF BASE) AS AS ESTIMATE OF ANNUAL REPLACEMENT COSTS DURING THE PROJECTION PERIOD.

TOTAL CAPITAL EXPENSES PER YEAR

YEAR	TOTAL CLASSROOM EXPENSE	TOTAL TEACHER HOUSING EXPENSE	TOTAL ADMINISTRATIVE FACILITY EXPENSE	TOTAL TOILET FACILITY EXPENSE	TOTAL CAPITAL EXPENSE
1978	$ 2,347,965	$ 3,086,406	$ 303,459	$ 560,306	$ 6,298,135
1979	$ 2,378,574	$ 4,225,968	$ 307,979	$ 566,102	$ 7,478,624
1980	$ 2,410,459	$ 3,126,816	$ 312,689	$ 572,139	$ 6,422,103
1981	$ 2,443,620	$ 1,979,172	$ 317,586	$ 578,418	$ 5,318,796

SYSTEM TOTALS

YEAR	TOTAL ENROLLMENTS	TOTAL QUALIFIED TEACHERS	TOTAL TEACHERS	TOTAL RECURRENT EXPENDITURES	TOTAL CAPITAL EXPENSE	TOTA EXPENS
1978	100,867	2,121	2,867	$ 3,924,381	$ 6,298,135	$ 10,222,51
1979	105,067	2,399	3,079	$ 4,588,567	$ 7,478,624	$ 12,067,19
1980	109,442	2,541	3,310	$ 5,232,505	$ 6,422,103	$ 11,654,60
1981	113,999	2,524	3,563	$ 5,855,996	$ 5,318,796	$ 11,174,79

SENSITIVITY ANALYSIS

At this point the user has the option of either terminating the run and storing the model for future use or entering the Sensitivity Analysis modual. The latter option is chosen by responding with a "2" to the initial question in this section. A second question asks if the user wants a list of the 22 variables subject to alteration and their current contents. In this example the user has responded positively.

```
ENTER (1) FOR A COMPLETE REBUILD OR (2) FOR SENSITIVITY ANALYSIS? 2

LISTING OF VARIABLES (YES/NO) ? YES

==========================================================================
LISTING OF VARIABLE NUMBER AND NAME
==========================================================================
NUMBER     NAME OF VARIABLE     (CURRENT CONTENTS)

  1        PROGRESSION RATE TABLE (TABLE VALUES)
  2        ENROLLMENT PROGRESSION METHOD (TARGET AND TECHNIQUE) (TABLE VALUES)
  3        NUMBER OF QUALIFIED EXPATRIATES AT END OF PROJECTION PERIOD ( 80 )
  4        ANNUAL NEWLY QUALIFIED TEACHERS (TABLE VALUES)
  5        TEACHER WASTAGE RATE ( .06 )
  6        DESIRED PUPIL-TEACHER RATIO AT END OF PROJECTION PERIOD ( 32 )
  7        PROJECTED AVERAGE TEACHER SALARIES (NEW TARGET) ( 1700 )
  8        PROJECTED PROPORTION OF TEACHERS PAID BY GOVERNMENT (NEW TARGET) ( 1
  9        CURRENT AND END OF PROJECTION TEACHER SALARIES ( 1547 )
  10       ADJ-FAC TOTAL EMOL TO TOT RECUR EXP AT END OF PROJECTION ( .9 )
  11       DESIRED SQ-FT CLASSROOM SPACE/STUDENT ( 20 )
  12       CLASSROOM CONSTRUCTION COST/SQ-FT ( 8.25 )
  13       CLASSROOM EQUIPMENT COST/SQ-FT ( .86 )
  14       DESIRED SQ-FT TEACHER HOUSING/TEACHER ( 900 )
  15       HOUSING CONSTRUCTION COST/SQ-FT ( 8 )
  16       HOUSE FURNISHING COST/SQ-FT ( .98 )
  17       DESIRED SQ-FT ADMINISTRATION FACILITY/STUDENT ( 3 )
  18       OFFICE CONSTRUCTION COST/SQ-FT ( 8.33 )
  19       OFFICE EQUIPMENT COST/SQ-FT ( .64 )
  20       DESIRED SQ-FT TOILET SPACE/STUDENT ( 1 )
  21       TOILET CONSTRUCTION COST/SQ-FT ( 34.5 )
  22       ANNUAL REPLACEMENT COST OF CAPITAL EQUIPMENT ( .05 )
==========================================================================
```

First Trial Sensitivity Run

In this run the user opted to change variable number 6 (Desired Pupil Teacher Ratio at End of Projection Period). A look at the table "Listing of Variable Number and Name" indicates that the initial value of this variable was 32. In the sensitivity run he has lowered the pupil/teacher ratio to a target of 30 in 1981.

The user did not opt to print all reports, and for this reason only the SYSTEM TOTALS display was printed. If the user had opted for all reports he would have also been able to trace the effects of this change through all intermediate tables in the model.

The reader should note that lowering the pupil/teacher ratio caused increases in "total teachers required," "total recurrent expenditures," and "total expenses." The remaining values in the SYSTEMS TOTALS table, however, remain unchanged. The total cost of this change in 1981 is projected to be 272,011 (i.e., 11,446,804 - 11,174,793 = 272,011). It is possible to specify the change in all system values (and over each year of the projection) by contrasting the system totals from the initial model with those resulting from the sensitivity run.

```
RUN WITH FILE UNCHANGED (YES/NO)? NO
INPUT SENSITIVITY VARIABLE NUMBER ? 6
INPUT SENSITIVITY VARIABLE VALUE? 30
OUTPUT ALL REPORTS (YES/NO) ? NO
```

SYSTEM TOTALS

YEAR	TOTAL ENROLLMENTS	TOTAL QUALIFIED TEACHERS	TOTAL TEACHERS	TOTAL RECURRENT EXPENDITURES	TOTAL CAPITAL EXPENSE	TOT EXPEN
1978	100,867	2,121	2,908	$ 3,958,929	$ 6,298,135	$ 10,257,0
1979	105,067	2,399	3,172	$ 4,675,690	$ 7,478,624	$ 12,154,3
1980	109,442	2,541	3,468	$ 5,396,563	$ 6,422,103	$ 11,818,6
1981	113,999	2,524	3,800	$ 6,128,008	$ 5,318,796	$ 11,446,8

Second Sensitivity Run

In this run the user opted to change his entries for teachers' salaries (variable 9). He wished to measure the impact of an immediate salary increase of 10% then allowing this new salary level to grow at 3% per year over the projection period.

The reader will note that the only values affected by this change are "total recurrent expenditures" and "total expense." The remaining totals do not change. The total cost of this salary increase is projected to be 280,913 by 1981 (i.e., 11,455,706 - 11,174,793 = 280,913).

```
RUN WITH FILE UNCHANGED (YES/NO)? NO
INPUT SENSITIVITY VARIABLE NUMBER ? 9
ENTER VALUE FOR 1978 QUALIFIED TEACHER'S SALARY ? 1645.60
ENTER VALUE FOR 1981 QUALIFIED TEACHER'S SALARY ? 1798.20
ENTER VALUE FOR 1978 UNQUALIFIED TEACHER'S SALARY ? 1108.80
ENTER VALUE FOR 1981 UNQUALIFIED TEACHER'S SALARY ? 1211.60
OUTPUT ALL REPORTS (YES/NO) ? NO
```

SYSTEM TOTALS

YEAR	TOTAL ENROLLMENTS	TOTAL QUALIFIED TEACHERS	TOTAL TEACHERS	TOTAL RECURRENT EXPENDITURES	TOTAL CAPITAL EXPENSE	TOTAL EXPENS
1978	100,867	2,121	2,867	$ 4,136,168	$ 6,298,135	$ 10,434,3
1979	105,067	2,399	3,079	$ 4,835,402	$ 7,478,624	$ 12,314,0
1980	109,442	2,541	3,310	$ 5,502,945	$ 6,422,103	$ 11,925,0
1981	113,999	2,524	3,563	$ 6,136,910	$ 5,318,796	$ 11,455,7

Third Sensitivity Run

In this run the user opted to change entries for variable number 4 (Annual Newly Qualified Teachers). Because this involves changing table values the printout includes the altered table as well as the SYSTEM TOTALS table even though the user opted not to print all reports.

A user may wish to use this sensitivity variable to project the costs of employing the graduates of a proposed (new) teacher training facility. Here we assumed this new facility would increase the number of qualified teachers by 100 additional teachers each year beginning in 1979. This change is shown to change all totals except enrollments in the SYSTEM TOTALS table. "Total recurrent expenditure" increases due to the higher salaries that must be paid to the increased numbers of qualified teachers. "Total capital expense" increases due to the increased number of teacher houses required for these new qualified teachers. Total expenditure in 1981 is projected to go up by 770,050 (11,944,850 - 11,174,793 = 770,050).

```
RUN WITH FILE UNCHANGED (YES/NO)? NO
INPUT SENSITIVITY VARIABLE NUMBER ? 4
OUTPUT ALL REPORTS (YES/NO) ? NO

FOR EACH YEAR INDICATED INPUT THE NUMBER OF NEWLY QUALIFIED
TEACHERS YOU EXPECT TO JOIN THE STAFF.

1978? 259
1979? 509
1980? 390
1981? 240
```

TOTAL SUPPLY OF QUALIFIED TEACHERS

YEAR	CITIZENS: QUALIFIED TEACHERS	CITIZENS: ADDITIONS TO TEACHING FORCE	CITIZENS: TOTAL QUALIFIED TEACHERS	NON-CITIZENS	TOTAL SUPPLY	TEACHERS LEAVING (ATTRITION AND NON CITIZENS)
1977	1,863	0	1,863	121	1,984	112
1978	1,751	259	2,010	111	2,121	131
1979	1,890	509	2,399	101	2,499	154
1980	2,255	390	2,645	90	2,735	169
1981	2,486	240	2,726	80	2,806	174

SYSTEM TOTALS

YEAR	TOTAL ENROLLMENTS	TOTAL QUALIFIED TEACHERS	TOTAL TEACHERS	TOTAL RECURRENT EXPENDITURES	TOTAL CAPITAL EXPENSE	TOT EXPEN
1978	100,867	2,121	2,867	$ 3,924,381	$ 6,298,135	$ 10,222,5
1979	105,067	2,499	3,079	$ 4,659,602	$ 8,286,824	$ 12,946,4
1980	109,442	2,735	3,310	$ 5,369,594	$ 7,181,811	$ 12,551,4
1981	113,999	2,806	3,562	$ 6,052,232	$ 5,892,618	$ 11,944,8

TECHNICAL DOCUMENTATION

Minimum equipment requirements to process the National Educational Expenditures Projection Model include:

1. Extended BASIC compiler.
2. At least 40k of useable primary storage, exclusive of allocations to operating system. The program is intended to function on a system with 64k primary storage.
3. Local terminal for user inputs.
4. Hardcopy output device (80 print positions).
5. Direct access storage device.

Several additional considerations need to be mentioned. This package has been modularized to function on the low cost, small capacity equipment that is currently available. Due to the relatively recent introduction of these systems there is limited documentation on their reliability.

The same segmentation which minimizes primary storage requirements creates a demand for the capability of chaining from segment to segment. The direct access storage device, previously mentioned, is intended to pass the input data along to each module. Disk storage is the preferred medium. Tape will serve but with considerable loss in speed.

It is expected that users may wish initially to purchase the minimum components necessary to process this package. Should equipment be upgraded at some later time the Projection Model will, with only minor alterations, remain compatible.

The BASIC language has not been standardized on an international level. For this reason, inconsistencies between the program code and the user's compiler may be encountered. Assistance from our staff in such circumstances is available.